

1. INTRODUCTION

The World Health Organization (WHO) describes overweight and obesity as one of today's most important public health problems, which is escalating as a global epidemic [1]. It is also increasingly recognized as a significant problem in developing countries and countries undergoing economic transition [2]. The problem of overweight and obesity is confined not only to adults but also being reported among the children and adolescents of developed as well as developing countries. Since, adolescence is a period of transition from childhood to adulthood; it assumes critical position in the life cycle of human beings, characterized by an exceptionally rapid rate of growth [3]. The prevalence of overweight and obesity among children and adolescents has increased significantly in the developed countries during the past two decades [4-8] and similar trends are being observed even in the developing world, though less rapidly [9-11].

This trend is of major concern, given the consequences that are associated with adolescent obesity both during adolescence [12, 13] and adult life [14] which include increased incidence of coronary artery diseases & hypertension [15, 16], diabetes [17], obstructive sleep apnoea [18], esophageal reflux & gastric emptying disturbances, osteoarthritis & flat feet [19], psychological dysfunction, self esteem & social isolation [12, 20], dyslipidaemia [21] and overall increase in morbidity and mortality in later life [22-24]. The most significant long-term consequence of childhood and adolescent obesity is its persistence into adulthood, with all the attendant health risks.

National Center for Health Statistics (NCHS), USA reported that nearly 15% of adolescents in the United States were obese. A recent study conducted among the affluent public school children in New Delhi, revealed prevalence of overweight (BMI ≥ 25 - < 30) and obesity (BMI ≥ 30) of about 25% and 7%, respectively [25]. Similarly, Subramanyam et al have reported that the prevalence of overweight and obesity among the affluent adolescent school children in Chennai, Tamil Nadu was about 15% [26]. There are evidences that children and adolescents of affluent families are increasingly becoming overweight/obese in recent times, possibly because of decreased physical activity & sedentary life styles [27] and change in dietary habits. In a prospective study of low and high risk children, Eck et al. found that the high risk group, who gained more weight during the 12 months study had slightly lower levels of total physical activity than the low risk group [28] and altered dietary behavioral patterns, especially with increased

consumption of fatty foods [29] or soft drinks [30]. There are, however, controversies and gaps in understanding the role of dietary composition in determining energy imbalance and subsequent weight gain and diet & physical activities in the aetiology of overweight and obesity [31-32].

Background Information

The State of Andhra Pradesh was formed in the year 1956 from the erstwhile composite State of Madras. It is situated in the tropical region between 12^o14' and 19^o54' North latitudes and 76^o46' and 84^o50' East longitudes. Andhra Pradesh bounded by Maharashtra in the North, Orissa and Madhya Pradesh in the Northeast, Bay of Bengal in the East, Tamil Nadu in the South and Karnataka in the west. Andhra Pradesh is the 5th largest state in the Indian Union both in terms of geographical area and population comprising of 23 districts, 9 in Andhra area, 4 in Rayalaseema and 10 in Telangana area. There are 1105 revenue *mandals* and 29,994 villages spreading over 2,76,814 sq. km (**Table A**). The total population of Andhra Pradesh is about 76.2 millions (2001 Census), with a population density of 275/Sq.Km and sex ratio of 978. About 27% of the population is urban and average per capita annual income is Rs.17,642.

Andhra Pradesh is predominantly agrarian and has the distinction of being called the "Rice Bowl" of South India. The State is normally surplus in rice production and contributes a major share of food grains annually to the central pool. Significant diversification in the economy is evident from the structural shifts in the State Domestic Product [33].

Table A: Profile of Andhra Pradesh

Variable	Men	Women	Total
Population (2001)	3,85,27,413	3,76,82,594	7,62,10,007
Per cent	50.6	49.4	100.0
Scheduled Castes (%)	-	-	16.2
Scheduled Tribe (%)	-	-	6.6
Urban Population (%)	-	-	27.08
Population density (Sq. Km)	-	-	275 /Sq. Km
Area (Sq. Km.)	-	-	2,75,100 Sq. Kms
Literacy (%)	70.3	50.4	60.5
Per Capita Income /Annum (Rs.)	-	-	17,642

Source: Directorate of Economics & Statistics of respective State Governments (As on March 26, 2004), Ministry of Health and Family Welfare, Govt. of India

Rationale of the study

Available evidences show that one of the effective ways to prevent obesity in the adult life may be prevention and management of childhood and adolescent overweight and obesity.

A fundamental step in the prevention and control of obesity is the identification of risk factors contributing to the rapid increase of obesity. Relevant research in this area, in India is minimal and the data available is mostly inconsistent and often based on statistically inadequate sample size, making it difficult to assess the prevalence of overweight and obesity at country as well as State level, in relation to a wide age range of adolescence (12-17 years).

Therefore, it was proposed to carry out a study to assess and identify the prevalence and correlates of overweight and obesity among urban adolescent school children covering statistically adequate sample in Andhra Pradesh, which is one of the economically, industrially and culturally fast growing State. The findings of the survey will help in formulation of strategies to prevent and control the problem among the target groups.

The present study was carried out in three regions i.e. Telangana, Andhra and Rayalaseema regions of Andhra Pradesh with the following objectives:

2. OBJECTIVES

2.1 General Objective

The general objective of the study was to assess the prevalence of overweight & obesity and its correlates among urban adolescent school children in the age group of 12-17 years in three regions of Andhra Pradesh.

2.2 Specific Objectives

1. To assess the prevalence of overweight and obesity among urban adolescent boys and girls in the State of Andhra Pradesh,
2. To assess the diet and nutrient intakes of adolescents by semi-quantitative food frequency questionnaire on a sub-sample of the subjects.
3. To assess the prevalence of physical activity levels on a sub-sample of the urban adolescents,

4. To assess the average time spent on TV viewing and playing video and computer games, among sub-sample of the adolescents,
5. To assess the knowledge and practices of adolescents with respect to nutrition, health and disease, and
6. To study the associations, if any, between overweight & obesity and other independent variables.

3. METHODOLOGY

3.1 Study design

It was a nested case control study mounted on cross sectional survey. The cross sectional survey was taken up through a multistage sampling to get appropriate representation.

3.2 Study subjects

The subjects were urban adolescent School/Junior College Children in the age group of 12-17 years in the State of Andhra Pradesh. The enrolment ratio in the urban schools and junior colleges of Andhra Pradesh was about 90%. Subjects were selected from government & private schools and junior colleges, in order to recruit them from different socioeconomic strata.

3.3 Sample Size

Studies carried out in the past have revealed that the prevalence of overweight and obesity among urban adolescents (12-17 years) was in the range of 6-10% [34]. Assuming a current prevalence of 7% overweight and obesity, with 95% confidence interval, 20% relative precision and 1.5 design effect to take care of interclass variation, sample size arrived at was 1914 children in each category of low and high-income and gender. However, the assessment of correlates was carried out among cases (overweight and obese adolescents) and double the number of controls (non-overweight subjects) [35], matched for region, type of school, age & gender and type of occupation of father.

3.4 Sampling Procedure

The State of Andhra Pradesh has three geographical regions i.e., Telangana, Andhra and Rayalaseema, which had distinct socio-cultural and food habits. In the First stage, about 12 schools (6 Private and 6 Government) and 8 colleges (4 Private and 4

Government) were selected from each region, from the list of schools/ colleges obtained from the Directorate of School Education and Secretary of Board of Intermediate Education, Government of Andhra Pradesh, in order to cover the required number of adolescents from low (Government schools & colleges) and high income (Private schools & colleges) category. From each of the selected schools, about 160 adolescents (@ 20 adolescents/ gender/age group), who are studying in 7th to 10th standard/class, were selected in order to draw the adolescents in the age group of 12 - 15 years. Similarly, 80 adolescents from each college studying in junior and senior intermediate classes (@ about 20 adolescents/age group/ gender) were also selected in order to draw the adolescents in the age group of 16 and 17 years (**Table B & Fig.1**).

Table B: Sample to be covered

Region	Schools (12 to 15 year age group)			Jr. Colleges (16 & 17 year age group)			Adolescents to be covered (@ 20 boys + 20 girls in each age group i.e. 12 to 17 years)		Pooled
	Govt. (LSE)	Pvt. (HSE)	Total	Govt. (LSE)	Pvt. (HSE)	Total	Boys	Girls	
Coastal Andhra	6	6	12	4	4	8	1280	1280	2560
Telangana	6	6	12	4	4	8	1280	1280	2560
Rayalaseema	6	6	12	4	4	8	1280	1280	2560
Pooled	18	18	36	12	12	24	3840	3840	7680

LSE: Low socioeconomic status
HSE: High socioeconomic status

3.5 Selection of Classes/Sections

In each class, wherever more than one section existed, one section was selected randomly and 20 boys and 20 girls from each class were covered randomly for the present study.

3.6 Ethical Considerations

The study protocol was submitted to the Institutional ethical Review Board and clearance was obtained. Written informed consent from the heads of the institutions and assent from the selected adolescents was also obtained, before initiation of the study in the respective institutions.

3.7 Data collection

The data was collected using pre-tested structured questionnaires. Bilingual questionnaire Telugu/English was administered to the selected adolescents from each of the selected class and the subjects were requested to record their responses in the presence of investigators, who provided necessary clarification to the queries, if any, in live classroom sessions. Anthropometric measurements such as height, weight, triceps, biceps, sub-scapular and supra-iliac fat fold thickness, mid upper arm circumference, waist and hip circumferences each of the adolescents were measured. Based on age and sex specific BMI centiles, the adolescents were classified as overweight and obese ($\geq 85^{\text{th}}$ centile) and non-overweight and non-obese ($< 85^{\text{th}}$ centile) [35]. All the adolescents with overweight / obesity were considered as cases and rest were treated as controls. Another questionnaire was administered to all the cases (overweight & obese subjects) and on double the number of controls (non-overweight and non-obese subjects) matched for age, gender, region and occupation of the father, to assess their life style patterns, dietary habits, leisure time spending, physical exercises, etc. Blood pressure was measured in all the cases and selected controls.

3.8 Investigations

The following investigations were carried out on all the subjects covered for anthropometry to screen overweight and non-overweight subjects

- ◆ Socioeconomic and demographic particulars
- ◆ Anthropometric measurements, such as height (cm), weight (kg), mid upper arm circumference, hip and waist circumference (cm) and fat fold thickness (mm) at triceps, biceps, sub-scapular and supra iliac sites.

The following investigations were carried out on sub-sample of subjects (all the overweight and obese adolescents and double the number of non-overweight and non-obese adolescents):

- ◆ Semi-quantitative Food Frequency diet survey
- ◆ Assessment of life style patterns
- ◆ Assessment of physical activity levels
- ◆ Knowledge & Practice on Nutrition, health and diseases
- ◆ Measurement of blood pressure
- ◆ Twenty-four hour recall method of diet survey was carried out on sub-sample of subjects

3.8.1 Socioeconomic and demographic data

Socio-economic particulars such as community, type of house, type of residence, number of rooms in the house, presence of home garden, availability of play ground at school/ college or near by residence, possession of household articles and information on type of fuel used for cooking purposes, mode of transport and distance from residence to school were collected.

3.8.2 Anthropometry

On each of the selected adolescent, height (cm), weight (kg), mid upper arm circumference (MUAC), waist and hip circumferences and triceps, biceps, sub-scapular and supra iliac fat fold thickness was measured using standard equipment and procedures [36].

3.8.3 Assessment of dietary patterns

Using Semi-quantitative Food Frequency questionnaire, the frequency of consumption of various foods for the past one-month was collected on all the overweight and obese subjects and on the double number of controls. Twenty-four hour recall diet survey was also carried out on a sub-sample from cases and controls.

3.8.4 Physical activity

Physical activity such as participation in indoor and out door games (hrs/week), aerobic exercises (hrs/day) like jogging, cycling, walking, *gym* and others (swimming/yoga/dancing), number of hours spent on resting and sleeping in a day, participation in the HH activities such as gardening, fetching water, going for shopping

etc., time spent on watching television, video and computer games during school time and holidays was collected.

3.8.5 Life style patterns

Information on dietary restrictions, if any, consumption of vegetables/ animal foods, extent of use of fatty / junk foods, use of medicines, tonics for good health, leisure time spending, habits and practices was also collected.

3.8.6 Knowledge on nutrition and balanced diets

Information on Knowledge of the children regarding nutrition during health, and disease was collected.

3.8.7 Measurement of blood pressure

Systolic and diastolic blood pressure was measured in sitting position using mercury sphygmomanometer on all the cases (overweight and obesity adolescents) and the controls. The measurements were made for three consecutive times, with a gap of 5 minutes between the measurements [37] and average of near consistent value was recorded.

3.9 Study Variables

3.9.1 Outcome variables:

The out come variables included:

- ◆ Body Mass Index (BMI)
- ◆ Waist and hip ratio (WHR)
- ◆ Percent Body fat
- ◆ Blood pressure (mm of Hg).

3.9.2 Predictor variables

The predictor variables included;

- ◆ Dietary patterns
- ◆ Socio-economic status
- ◆ Physical Activity levels
- ◆ Knowledge and Practices of the adolescents on health & nutrition and diseases

3.10 Survey Instruments

3.10.1 Questionnaires

Two types of pre-tested and validated questionnaires were used, one to collect socioeconomic & demographic particulars and the other to cover information on dietary

behaviors and life style pattern including physical activity level, frequency of consumption of various foods and knowledge and practices of adolescents during health and disease with respect to nutrition.

3.10.2 Equipment

Portable anthropometric rod was used to measure heights of the adolescents to the nearest 1mm and SECA electronic balance was used to measure the weight (Kg) with an accuracy of 100gm. Harpenden skin fold calipers was used to measure skin fold thickness at triceps, biceps, sub-scapular and supra iliac to nearest 0.2mm. Arm, waist and hip circumferences were measured using non-elastic fibre reinforced plastic measuring tapes to the nearest mm. All the measurements were taken by using standard procedures as described by Jelliffe [36].

4. RECRUITMENT OF INVESTIGATORS, TRAINING & STANDARDIZATION

Four teams, each consists of two Research Assistants (1 Nutritionist and 1 Social worker) and one Field Investigator were recruited. All the investigators were trained for about 3 weeks were standardized in the various methodologies adopted in the study to minimise inter and intra individual variations in the measurements.

5. DATA ANALYSIS

The data was scrutinized, cleaned, and then entered into the computer, for analysis using SPSS, Window version 14.5 a univariate, bivariate and multivariate analysis was carried out.

In the present survey, the total number of adolescents covered was 9,129. Out of these, 8,142 were considered for analysis and the remaining 987 were not considered for analysis due to >12 years or ≤18 years. Further, 237 adolescents have not cooperated for anthropometric measurements. Out of 448 cases, 314 were covered for information on life style practices, food habits and measurement of blood pressure etc. About 92 adolescents were absent on the subsequent days of survey and 42 children have not cooperated (**Fig.2**).

5.1 Definition of overweight and obesity

The mean heights and weights and BMI ± standard deviations (SD) were computed for each group viz. non-overweight/ non-obese and overweight and obese for the purpose of comparison.

Using Body Mass Index [Weight (Kg)/Height (meters)²] age and gender specific centile, adolescent boys and girls were categorized into two groups [35], as non-overweight and non-obese (< 85th centile) and overweight and obese adolescents (\geq 85th centile).

5.2 Socio-economic status

Since, current assessment of family income from the adolescents was not feasible, socioeconomic index was computed using a few proxy indicators, which were captured in the present survey questionnaire.

The proxy income variables included community, type of cooking fuel used, occupation of the father and mother and possession of HH articles. To calculate composite socioeconomic index (CSEI), all the socioeconomic proxy variables were given a logical score (1-5), as followed in NFHS–2 and NCAER surveys. The total score was added up into a grand score.

A logical score was given for each of the socioeconomic variable such as community, occupation of father & mother, use of fuel for cooking purpose, household durable goods, to derive a composite socioeconomic score. Using the composite socioeconomic score, the adolescents were categorized into two socioeconomic groups viz. i) low socioeconomic status (LSES) (score < 27) and, ii) high socioeconomic score (HSES) (score of \geq 27).

5.3 Body fat composition

The sum of skin-folds was determined by summing the values of triceps, biceps, sub-scapular and supra iliac skin-folds. Body density was calculated for each of the child using gender specific regression equations. Body fat percent was calculated using the Siri's equation {Fat % = [(4.95/density) – 4.5] x 100} [38].

5.4 Factor analysis

Factor analysis (statistical data reduction technique) was used to explain variability among observed variables in terms of fewer unobserved variables called factors. The observed variables are modeled as linear combinations of the factors, plus "error" terms. The factors were rotated by an orthogonal transformation using the Varimax rotation function to achieve a structure with independent (non-overlapping) factors and greater potential for interpretability. In determining the number of factors to

retain, a given value over 1.0 as the criteria for retaining factors [39]. The dietary patterns are usually described by Factor Analysis.

5.5 Multiple logistic regression

Multiple logistic analyses were carried out to examine associations between independent variables and overweight & obesity. The logistic model is a multivariate analysis model by which the odds ratio (good approximate value for the relative risk) of prognostic factors is calculated by logit variable (the natural log of the odds of the dependent occurring or not) transformation of the probability of the development of the end point, and thus the degree of the involvement of each factor in the development of overweight & obesity could be estimated using this model. When the 95% confidence interval of the relative risk of a given factor does not include 1, the value is significant (significance level, 0.05). To adjust for the effects of each factor, these factors were simultaneously incorporated into the model.

6. RESULTS

6.1 Coverage

The particulars of the sample covered are presented in the **Tables 1 & 2 & Fig.2**.

Of the total 512 Government and 3,981 Private high schools from the urban areas of the region, 6 Government and 9 private schools were selected and covered. Similarly, out of 244 Government and 996 private junior colleges, 4 Government and 5 private colleges were also covered for the present survey. A total of 1,224 and 268 adolescents respectively from Government high schools and junior colleges and 926 and 310 adolescents respectively from private schools and colleges were selected respectively for the study. Thus, a total 2,728 adolescents (boys: 1299) were covered from the 24 Institutions from the region.

Of the total 390 Government and 2,479 Private high schools from the urban areas of the region, 6 Government and 7 private schools were covered. Similarly, out of 162 Government and 746 private junior colleges, 4 from each category were selected for the present survey. A total of 1,025 and 499 adolescents respectively from Government high schools and junior colleges and 847 and 330 adolescents respectively from private schools and colleges were selected for the study. Thus, a total 2,701 adolescents (boys: 1431) were covered from the 21 Institutions for the present survey from the region.

Of the total 64 Government and 960 Private high schools from the urban areas of the region, 6 Government and 7 private schools were covered. Similarly, out of 96 Government and 299 private junior colleges, 4 from each category were also covered for the present survey. A total of 1,038 and 343 adolescents respectively from Government high schools and junior colleges and 899 and 433 adolescents from private high schools and junior colleges were selected respectively for the present survey. Thus, a total 2,713 adolescents (boys: 1644) were covered from the 21 Institutions for the present survey in the region.

At the State level, the adolescent boys constituted 54% and the adolescent girls constituted 46% (**Table 2**). However, in the region of Rayalaseema, the proportion of girls covered was low as compared to boys.

6.2 Composite Socio-economic Index (CSEI)

Based on the median score, two socioeconomic categories were made as low socioeconomic status (LSES) and high socioeconomic Status (HSES). About 52% of children belonged to the high socio-economic status, while 48% in low socio-economic status.

6.3 Sample Characteristics

The sample characteristics are provided in the **Table 3**.

6.3.1 Community

Overall, about 44% of adolescents belonged to other backward communities (OBCs) and a fifth of them were Scheduled Caste/tribes (19.4%). The proportion of OBCs (51.6%) and scheduled caste/tribes (28.8%) was higher in low socioeconomic status as compared to high socioeconomic status (34.5% & 9% respectively).

In general, about 44% adolescents belonged to OBCs and a quarter of HHs belonged to Scheduled caste/tribe communities (24.5%). The proportion of adolescents belonging to OBCs (52.3%) and Scheduled caste/tribes (36.8%) was higher in LSES compared to high socioeconomic group (HSES).

In general, about 46% adolescents belonged to OBCs and 18% were belonged to Scheduled caste/tribes. The proportion adolescents belonging to OBCs (53.8%) and Scheduled caste/tribes (25%) were higher in LSES as compared to HSES.

In general, 40% adolescents belonged to OBCs and about 16% belonged to Scheduled caste/tribes. The proportion of adolescents belonging to OBCs (48.6%) and Scheduled caste/tribes (24.5%) was higher in LSES as compared to HSES.

6.3.2 Occupation of the parents

In general, majority of the adolescents' (51.1%) father occupation was either service (30.4%) or business (20.7%), followed by labourers (38%), artisans (5.9%) and others (5%). The proportion of adolescents whose fathers were involved in labour was significantly ($p < 0.0001$) higher in LSES (63%) as compared to HSES (10.5%) in all the 3 regions (**Table 3 & Fig. 3**).

A majority of the adolescent's (61.5%) father occupation was either service (39.5%) or business (22%), followed by labourers (29%), artisans (3.8%) and others (5.6%). However, the proportion of fathers' involved in service (58.4%) and business (31.2%) was significantly higher in the HSES as compared to the LSES (22.6 % 13.9% respectively).

A majority of adolescents' (45%) father occupation was either service (25.1%) or business (20.2%) and another 45% were involved in labour. However, the proportion engaged either in service and business was significantly ($p < 0.05$) higher in HSES (75.3%) as compared to LSES (19.1%).

About 47% of the adolescents' father occupation was either service (26.6%) or business (20%), followed by labour (39.8%), artisans (8.7%) and others (4.8%). However, the proportion engaged either in service (49.6%) or in business (31.2%) was significantly higher in HSES as compared to LSES (4.4% & 9.1% respectively).

In general, the occupation of adolescents' mother was either housewife (62%) or labourer (22%). The proportion of mothers engaged in labour was significantly higher (39.5%) in LSES compared to HSES (2.7%). Whereas the proportion of mothers engaged in housewife was significantly higher in HSES (76.8%) compared to LSES (48%). Similar trend was observed in all the regions.

6.3.3 Literacy status of Parents

In general, about 81% of adolescents fathers and 64% of mothers were literate. The proportion of literate parents was essentially similar in all the regions (Father: 80-82%; Mother: 31-40%). In general, the proportion of parents with educational level of college and above was significantly higher among HSES (Father: 43.9%; Mother: 21.2%)

as compared to LSES (Father: 2.3%; Mother: 4%) were observed in all the three regions (Table 3 & Fig. 4).

6.3.4 Family size

In general, the proportion of HHs having the family size of ≥ 5 was about 61%. The proportion was marginally higher among LSES households (67.4%) compared to HSES (52.8%). Similar trend was observed in all the 3 regions.

6.3.5 Type of residence

In general, majority of the households of adolescents (86.5%) were residing in their own houses and a similar trends were observed in all the regions (85-88%) as well as in both the socioeconomic groups (80-90%).

6.3.6 Type of house

In general, two thirds of adolescents (60.7%) were living in *pucca* houses, while about 29% in semi-*pucca* houses. The proportion of adolescents whose households were living in *pucca* houses were significantly ($p < 0.05$) higher among HSES (82.5%) as compared to LSES (40.7%), while a significantly ($p < 0.05$) higher proportion of adolescents from LSES (17.9%) were living in *kutcha* houses as compared to HSES (1.5%) ((Table 3 & Fig. 5)).

6.3.7 Number of living rooms

In general, a majority of the HHs of adolescents (70.8%) were residing in houses having ≤ 3 living rooms. The proportion was significantly ($p < 0.05$) higher in the HHs belonging to LSES (91-96%) as compared to HSES (37-53%) in all the regions.

6.3.8 Use of cooking fuel

In general, a majority of the households (60%) were using liquefied petroleum gas (LPG) as cooking fuel, while the rest were using either firewood or kerosene. The proportion of HHs using LPG was significantly ($p < 0.05$) higher in the HHs of HSES (93.2%) as compared to LSES (30.5%).

6.3.9 Availability of play ground

In general, about 83% of Adolescents reported that their schools had play grounds, while only about 40% of the adolescents also stated that play grounds were available nearby their houses. However, the proportion was not significantly different with respect to socioeconomic status and region.

6.3.10 Presence of Home garden

In general, about 18.7% of the HHs (reportedly had home gardens. Their proportion was significantly ($p < 0.05$) higher in the Telangana region (26.6%) as compared to other regions (11-18%). However, the presence of home gardens was significantly ($p < 0.05$) higher in the HHs belonging to HSES (17-36%) as compared to LSES (6-18%) in all the regions.

6.4 Possession of HH articles

In general, majority of the HHs (80%) had television (TV) sets in their homes. The proportion was significantly ($p < 0.05$) higher in the HHs belonging to HSES (96.8%) as compared to LSES (64.8%). A similar trend was observed in all the 3 regions (Telangana: 98.1% vs 70%; Coastal Andhra: 96.3% vs 61.1%; Rayalaseema: 96% vs 63.1%). About one third of HHs had radio, scooter/motor cycle and audio systems in their houses; while about half of the HHs had mobile phones (49.6%). About a quarter of HHs had landline telephones (27.3%) and refrigerators (26.7%). However, the proportion of households possessing different types of HH articles was relatively higher in Telangana as compared to other two regions (**Table 4 & Fig. 6**). The proportion of possession of HH articles was significantly ($p < 0.05$) higher in the HHs belonging to HSES as compared to LSES in all the 3 regions.

6.5 Anthropometric measurements

6.5.1 Mean weight, height and Body Mass Index (BMI)

The mean weight of adolescent boys ranged from 34.7 kg in 12 year old to 51.3 kg in 17-year-old, while in case of girls, it ranged from 37.4 kg in 12 year old to 45.3 kg in 17 year old (**Tables 5.1-5.2 & Fig. 7**).

In general, mean height of the boys ranged from 146.1 cm in 12 year old to 165.9 cm in 17-year-old boys, while in girls, it ranged from 147.4 cm in 12 year old to 153.6 cm in 17 year old. The mean heights and weights of the adolescent boys and girls were higher in Telangana region as compared to their counter parts in Rayalaseema and in Coastal Andhra.

In general, the mean BMI among adolescent boys was 17 and ranged from 16.0 in 12 year old to 18.5 in 17 year old. In case of girls, the mean BMI was 18.1 and it ranged from 17 in 12 year old to 19.1 in 17-year-old girls. The mean BMI among 12-17 year old adolescent boys was marginally higher in Telangana region (17.3) as compared to

Coastal Andhra (17) and Rayalaseema regions (16.7) (**Table 5.1-5.2 & Fig. 7**). A similar trend was observed among the adolescent girls.

6.5.2 Mean MUAC, Waist Circumference, and Hip Circumference

The mean mid upper arm circumference (MUAC) among 12-17 year adolescent boys ranged from 19.1 cm in 12 years to 23.3 cm in 17 years, while in case of girls, it ranged from 20.1 cm in 12 years to 22.3 cm in 17 years. The mean MUAC among 12-17 year adolescent boys tended to be marginally higher in Telangana region (21.3 cm) as compared to Rayalaseema and Coastal Andhra. No such differentials were observed in case of girls, of different regions.

The mean waist circumference (WC) among 12-17 years adolescent boys ranged from 59.3 cm in 12 years to 67.2 cm in 17 years. The mean WC among 12-17 year adolescent boys was marginally higher in Telangana as compared to Rayalaseema and Coastal Andhra. No such differences were observed among girls of different regions.

The mean hip circumference (HC) among 12-17 year adolescent boys ranged from 71.8 cm in 12 years to 84.2 cm in 17 years, while in case of girls, it ranged from 77.4 cm in 12 years to 85.9 dm in 17 years. The mean HC among 12-17 year adolescent boys was marginally higher in Telangana region as compared to Coastal Andhra and Rayalaseema regions. In case of girls, the mean HC was marginally higher in Coastal Andhra as compared to Rayalaseema and Telangana (**Table 6.1-6.2**).

6.5.3 Mean BMI age and sex specific centile

In general, the mean BMI was about 17, 25 and 30 in <85th, ≥85-<95th and ≥95th centiles respectively. The proportion of children in <85th, ≥85-<95th and ≥95th were 94.3%, 5.1% and 0.6% respectively (**Table 8**).

6.6. Prevalence of Overweight and Obesity

In general, the prevalence of overweight and obesity was 5.7% among the adolescents of 12-17 years ranged from 4.8% in Coastal Andhra and 6.8% in Telangana. There were significant ($p < 0.05$) gender differentials observed in the prevalence of overweight and obesity (Boys: 4.4%; Girls: 7.1%). In general, the proportion was marginally higher among 12 and 17 year old (6.3-6.5%) as compared to 13 to 16 years (5.2-6.0%). The prevalence of overweight and obesity was significantly higher among the adolescents of Telangana (6.8%) as compared to Rayalaseema (5.4%) and Coastal Andhra (4.8) (**Table 9 & Fig. 9-10**).

6.6.1 Prevalence of overweight and obesity vs. type of institution

In general, the prevalence of overweight and obesity was significantly ($p < 0.001$) higher among the adolescents studying in private institutions (9.6%) as compared to government institutions (2.4%). There were no significant differentials observed in the prevalence of overweight and obesity among adolescents studying in government institutions between the regions, while there was a significant difference ($p < 0.05$) observed in the prevalence of overweight and obesity among adolescents (12-17 year old) studying in private institutions between the regions (Tel: 12.4%; Ray: 8.8% & Andhra: 7.4%). There were significant ($p < 0.05$) gender differentials observed in the prevalence of overweight and obesity among the adolescents studying in both type of institutions (**Table 10 & Fig.11**).

6.6.2 Prevalence of overweight and obesity Vs Socioeconomic and demographic variables

The prevalence of overweight and obesity and its associated factors are provided in the **Tables 11-13**.

6.6.3 Prevalence of overweight and obesity by Socio-economic composite Index (SECI)

In general, the prevalence of overweight and obesity was significantly higher ($p < 0.001$) among the adolescents of high socioeconomic status (9.6%) as compared to the low socioeconomic status (2.1%). This trend was also observed in all the regions viz. Telangana (12.3% vs 2%), Rayalaseema (8.1% vs 2.4%) and Coastal Andhra ($p < 0.001$). Significant ($p < 0.05$) gender differentials were also observed in both the socioeconomic status (LSES: boys 1.3; girls 3.1; HSES: boys: 8.2; girls: 11.1) in all the regions (**Table11 & Fig.12**).

6.6.4 Prevalence of overweight and obesity by Community

A higher proportion of adolescents were found to be overweight or obese in the forward communities (9.1%) as compared to the adolescents of backward communities (3.9%) and scheduled castes/tribes (2.3%). Similar trends were observed in all the 3 regions viz. Telangana (ST: 1.5%; SC: 4.1%; BC: 4.3% & others: 13.1%), Coastal Andhra (ST: 3.4%; SC: 3.3%; BC: 3.3% & others: 7.5%) and Rayalaseema (SC: 2.5%; ST: 2.9%; BC: 4.1% & others: 7.4%) (**Table 12**).

6.6.5 Prevalence of overweight and obesity by Occupation of the Parents

The prevalence of overweight and obesity was significantly ($p < 0.05$) higher among the adolescents, whose parents were in service (8-11%) or engaged in business (9%) compared to other occupations (2-6%). Similar trends were observed in all the regions of the State (**Table 12 & Fig. 13**).

6.6.6 Prevalence of overweight and obesity by Literacy Status of Parents

In general, the prevalence of overweight and obesity was significantly ($p < 0.05$) higher among the adolescents, whose fathers were educated up to college and above (12.4%) as compared to the adolescents, whose fathers were illiterate (2%) or had education less than secondary level (3-6%). A similar trend was observed in all the 3 regions of the State (**Table 12 & Fig. 14**).

The prevalence of overweight and obesity was significantly ($p < 0.05$) higher among the adolescents whose mothers were educated up to college and above (16.1%) as compared to adolescents, whose mothers were illiterate or had education less than secondary level (2.8%) (**Table 13**).

6.6.7 Prevalence of overweight and obesity by Family Size

In general, the prevalence of overweight and obesity was significantly ($p < 0.05$) higher among the adolescents whose HHs had the family size of ≤ 4 (7.6%) as compared to those with family size of ≥ 5 (4.4%). A similar trend was observed in all the 3 regions (**Table 13**).

6.6.8 Prevalence of overweight and obesity by Type of house

The overall prevalence of overweight and obesity was significantly ($p < 0.05$) higher among the adolescents, who were residing in *pucca* houses (7.6%) as compared to semi-*pucca* (3.1%) and *kutchra* houses (1.4%). Similar trends were also observed in all the three regions (**Table 13**).

6.6.9 Prevalence of overweight and obesity by Number of living rooms in the House

In general, the prevalence of overweight and obesity was significantly ($p < 0.05$) higher among the adolescents, who were living in houses with ≥ 7 rooms (17%) compared to houses with ≤ 3 rooms (3.5%) or 4 -6 rooms (10.1%). Similar trends were also observed in all the regions of the State (**Table 13**).

6.6.10 Prevalence of overweight and obesity by Type of cooking fuel used

In general, the prevalence of overweight and obesity was significantly ($p < 0.05$) higher among the adolescents, who were using LPG/Biogas as cooking fuel in their houses (8.2%) compared to firewood (1.8%) or Kerosene (2.9%). A similar trend was observed in all the three regions of the State (**Table 13**).

6.6.11 Prevalence of overweight and obesity by Availability of play ground

In general, the prevalence of overweight and obesity was significantly ($p < 0.05$) lower among the adolescents, who were having playground (5.2%) as compared to its absence at school (7.8%). A similar trend was observed in all the three regions of the State (**Table 13**). However, there were no significant differentials observed with or without having a play ground nearby house.

6.6.12 Prevalence of overweight and obesity by Presence of home garden

In general, the prevalence of overweight and obesity was significantly ($p < 0.05$) higher among the adolescents, who were having home gardens in their house premises (7.7%), compared to its absence (5.2%). A similar trend was observed in three regions of the State (**Table 13**).

7. CORRELATES OF OVERWEIGHT AND OBESITY AMONG URBAN ADOLESCENTS

7.1 Physical Activity patterns among Cases and Controls

7.1.1 Participation of Adolescents (cases & controls) in physical activities

The patterns of physical activities among overweight and obese adolescents (cases) and non-overweight and non-obese adolescents (controls) are provided in **Table 14**.

7.1.1.1 Participation in out door sports and games

The proportion of adolescents, who participated in out door sports and games were significantly higher ($p < 0.05$) in control group (66.7%) as compared to that of cases (54.5%). In general, the average duration of participation of controls in out door sports and games (3.7hrs/wk) was significantly higher ($p < 0.001$) as compared to cases (2.3hrs/week). Barring in Rayalaseema, similar trend was observed in Telangana and Coastal Andhra regions. There were significant gender differentials ($p < 0.001$) observed in the participation (cases: boys: 67.4%; girls: 44.7% vs controls: boys: 84.4%; girls: 53.2%) as well as duration of participation (cases: boys: 3.5hrs/wk; girls: 1.4h/wk vs

controls: boys: 5.9hrs/wk; girls: 2.2hrs/wk) in out door sports and games of adolescents of both cases and controls (**Fig. 15**).

7.1.1.2 Participation in indoor sports and games

The proportion of adolescents, who participated in indoor sports and games, was not significantly different among cases (68.2%) and controls (70.3%). However, the average duration of participation of controls in indoor sports and games (2.7hrs/day) was significantly higher compared to cases (2.1 hrs/day). Significant gender differentials ($p<0.05$) were observed in the participation (Cases: Boys: 70.4%; Girls: 66.5% vs Controls: Boys: 74.4%; Girls: 67.2%) and duration of participation (Cases: Boys: 2.5hrs/wk; Girls: 1.7hrs/week vs Controls: Boys: 3.3hrs/wk; Girls: 2.3hrs/wk) of adolescents of both the groups in indoor sports and games.

7.1.1.3 Participation in Physical Exercises

In general, the participation of adolescents in physical exercises like jogging, walking, running, yoga, swimming etc. was not significantly different between cases and controls (Cases: 46.2; Controls: 45.3%). A similar trend was observed in all the regions, except Rayalaseema (29.6%; Controls: 33.8%). However, the average duration of participation in physical exercise was significantly ($p<0.05$) different between the controls (4.1hrs/week) and cases (3.5hrs/week). A similar trend was seen in the regions of Coastal Andhra (Controls: 4.5hrs/week; Cases: 4.2hrs/week) and Rayalaseema (3.0hrs/week; 1.5hrs/week).

7.1.1.4 Participation in Household Activities

Participation of adolescents in household activities is considered as substantial physical activity. In general, the participation of adolescents in household activities like sweeping the house, fetching the water, getting groceries from nearby shops etc. was marginally higher in controls (77.2%) as compared to cases (70.4%). No significant gender differentials were observed in both the groups.

The average duration of participation in household activities was relatively higher among controls (0.8hrs/day) as compared to cases (0.6hrs/day). Similar trend was observed in the regions of Telangana (Controls: 0.7hrs/day; Cases: 0.5hrs/day) and Coastal Andhra (Controls: 1.0hrs/day; Cases: 0.6hrs/day) (**Fig. 16**).

7.1.1.5 Participation NCC/NSS/Scouts & Guides Activities

The participation in NCCs/NSS/Scouts & guides was similar between two groups (Cases: 8.9%; Controls: 7.7%).

7.1.2 Participation in physical inactivities

The patterns of physical activities among overweight and obese adolescents (cases) and non-overweight and non-obese adolescents (controls) are provided in **Table 14**.

7.1.2.1 Participation in TV watching

While a majority of the adolescents were reportedly watching TV on school days (cases: 87%; controls: 88%), it was about 94% each among cases and controls on holidays. The average duration of watching TV on school day was significantly ($p < 0.05$) higher among the cases (1.4hrs/day) as compared to controls (1.2hrs/day), while it was 3.9 hrs/day and 3.3hrs/day on holidays respectively among cases and controls (**Fig. 17**).

7.1.2.2 Participation in Home work/Reading/Tuitions

In general, the average duration of participation either in home work/reading or tuitions was not significantly different between the cases and controls.

7.1.2.3 Duration of Sleep during day and night

In general, the average duration of nap (day sleep) was significantly ($p < 0.05$) higher among overweight adolescents (12 min/day) as compared to controls (6min/day). In case of Rayalaseema none of the adolescents in both groups were taking the nap. The average duration of the sleep during night was more or less same in both cases (7.2hrs/day) and controls (7.4 hrs/day).

7.1.2.4 Distance from Residence to School

The proportion of adolescents studying in the schools located at a distance of <1km from their home was marginally higher in control group (48.3%) as compared to cases (42.4%). A similar trend was observed in the regions of Telangana and Coastal Andhra. Only about 4-5% schools were located about a distance of ≥ 10 km. There were no significant differentials observed between the cases and controls (**Table 15**).

7.1.2.5 Use of mode of transport

The proportion of adolescents going to school by either walking (cases: 34.7%; controls: 32.9%) and by means of transport (school/college bus/Auto rickshaw) (cases: 23.8%; controls: 22.2%) was not significantly different between cases and control

groups. However, the proportion of children using bicycle was significantly higher among controls, while it was higher among cases using scooter/car as mode of transport to go to the schools (**Table 15 & Fig. 18**).

7.2 Perceptions, habits and practices among cases and controls

The perceptions, habits and practices among overweight and obese (cases) and non-overweight and non-obese adolescents (controls) are provided in the **Table 16**.

7.2.1 Perception about body size

In general, about 60% of controls and 21% of cases perceived that their body size was normal. About two third of cases (63%) and 12% of controls perceived that they were overweight and obese. Similar trends were seen in all the regions. Surprisingly, about 5% of overweight and obese adolescents still perceived, that they were lean (**Fig. 19**).

7.2.2 Desirable level of body size

About 80% and 25% of controls expressed their desire to slim down, only about 3% of overweight and obese adolescents wanted to put on weight, while 14% wanted to maintain the same weight in future too. Similar trend was observed in all the three regions.

7.2.3 Type of diet consumption

In general, the proportion of adolescents consuming non-vegetarian diet was significantly ($p < 0.05$) higher in the cases (68%) as compared to control group (60.8%). The proportion of adolescents consuming vegetarian diet + egg was marginally higher in the controls (18.3%) as compared to cases (12.7%). No significant ($p < 0.05$) differentials were observed in the proportion of adolescents in consumption of vegetarian diet between the cases and controls (**Fig.20**).

About three fourths (69-70%) of adolescents were reportedly preferred consumption of fatty foods in both the cases and controls, since they liked the same. Similar trend was observed in all the three regions.

7.2.4 Type of oil consumption

In general, a majority (51-56%) of the HHs was reportedly using sunflower oil as cooking oil in both the cases and control group. A quarter of HHs was also using groundnut oil as cooking oil in both the groups. It is nutritionally advisable to use more than one oil. However, only about 6% HHs was using multiple oils among both the cases and controls.

7.2.5 Practice of dietary restrictions and use of health tonics

A significantly higher ($p < 0.05$) proportion of adolescents among the cases (23.9%) followed dietary restrictions as compared to the controls (15.8%). While similar trend was observed in Telangana and Coastal Andhra regions, no significant difference was found in Rayalaseema region. The proportion of adolescents using of health tonics was marginally higher among the controls (9.4%), as compared to cases (5.7%).

7.3 Physical Activity

7.3.1 Participation of cases and control group in out door games & sports

In general, the proportion of adolescents, who were participating in out door games was significantly ($p < 0.001$) lower in cases (54.5%) compared to controls (66.7%). The proportion of adolescents, who were participating for ≥ 6 hrs/ week was significantly ($p < 0.001$) higher among the controls (31.9%) compared to cases (17.5%). A similar trend was observed in all the three regions (**Table 17 & Fig. 21**).

7.3.2 Participation of cases and controls in indoor games & sports

The proportion of adolescents, who were participating in indoor games, was marginally lower in cases (68.2%) compared to controls (70.3%). The proportion of adolescents, who were participating for ≥ 6 hrs/week was significantly higher among the controls (17.1%) compared to cases (10.2%). A similar trend was seen in all the three regions (**Table 17**).

7.3.3 Participation in Household chores

The proportion of adolescents, who were participating in household chores, was significantly ($p < 0.05$) lower in the cases (74.8%) as compared to controls (90.2%). The proportion of adolescents, who participated for ≥ 2 hrs/ day, was significantly ($p < 0.05$) higher among the controls (18.5%) compared to cases (11.8%). A similar trend was observed in the Telangana and Coastal Andhra region (**Table 17 & Fig. 22**).

7.3.4 Participation of cases and control group in physical exercises

No significant differentials were observed in the proportion of adolescents, participating in the physical exercises between cases and controls (**Table 17**).

7.3.5 Duration of TV watching

A significantly ($p < 0.001$) higher proportion of cases (16.2%) were reportedly watching TV ≥ 3 hrs/day on school day as compared to control group (8.5%). A

significantly higher proportion of cases (80%) were reportedly watching TV on holiday for ≥ 3 hrs/ day compared to control group (65.1%) in the Costal Andhra, while in other regions, it was similar between cases to controls (**Table 17 & Fig. 23**).

7.3.6. Prevalence of overweight & obesity and Frequency of consumption of various foods

The frequency of consumption of various foods with reference to cases and control group is provided in **Table 18.1-18.3**.

The frequency of intake of fast foods such as burgers and noodles was significantly ($p < 0.05$) higher among the cases compared to the control group, while intake of foods, such as milk, buttermilk, fish curry and lemon rice was significantly higher among the control group as compared to the cases.

7.4 Food & nutrient intakes

7.4.1 Consumption of foodstuffs

The particulars of average daily intake of Food and Nutrients based on 24-hour recall method of diet survey are provided in the **Table 19.1 & 19.2**.

The intake of cereals & millets, other vegetables, condiments & spices, was significantly ($p < 0.05$) higher among the cases (334g, 57g and 19g) compared to the controls (279g, 33g and 13g). However, the average daily intake of GLV, though low was marginally higher and that of fruits was significantly ($p < 0.05$) higher in the control group (16g and 56g respectively) compared to cases (12g and 53g) respectively. The intake of pulses, roots & tubers, fish and flesh foods, milk & milk products, fats & oils and sugar & jaggery was marginally higher among cases as compared to the control group (**Table 19.1**).

7.4.2 Intake of Nutrients

The mean intake of protein, energy, thiamin, niacin, vitamin C and iron were significantly ($p < 0.05$) higher among the cases compared to the controls. The intake of fat, calcium, riboflavin and folic acid were marginally higher in cases as compared to control group. However, the intake of vitamin A was marginally higher among control as compared to the cases (**Table 19.2**).

The prevalence of overweight and obesity was significantly higher among the adolescents, who had intakes of nutrients $\geq 70\%$ of RDA as compared to $< 70\%$ of RDA, with respect to protein (54.9% Vs 30.9%) and energy (50.8% Vs 30.4%).

7.5 Prevalence of hypertension among Adolescents (Cases and control group)

The mean systolic blood pressure (SBP) was significantly ($p < 0.05$) higher among the cases (111mm of Hg), compared to controls (103 mm of Hg). The prevalence of hypertension (JNC Criteria VII) was significantly ($p < 0.05$) higher among the overweight and obese adolescents (8.3%) as compared to control group (3.7%). Significant gender differentials were observed in the prevalence of hypertension among cases (Boys: 10.4%; Girls: 6.7%) and controls (boys: 7.8; girls: 0.6%). Similar trend was observed in all the three regions (**Table 20**).

7.6 Mean percent body fat

The mean percent body fat among adolescent boys with overweight/ obesity was significantly higher (31.2%) as against non-obese children (17%). In case of girls, the mean body fat percentage among overweight / obese adolescents was about 36%, as against 27% among non-overweight and non-obese adolescents (**Tables 7 & 21**). Significant gender differentials observed in the mean percent body fat between both categories of adolescents, the girls having higher percent of body fat compared to girls.

7.7 Mean body fat Percent vs Socioeconomic Status

In general, the mean body fat percent among non-overweight and non-obese boys, who are from low socioeconomic, was about 21%, while it was significantly higher among overweight and obese adolescents (32.9%). In case of non-overweight and non-obese adolescents of girls, the mean body fat percentage was about 23%, while it was 34% among overweight and obese adolescents (**Table 22**).

7.8 Factor Analysis

Factor analysis was used to derive food patterns based on the information collected on 61 food items from 789 adolescents using semi-quantitative food frequency questionnaire (FFQ). In the analysis, 18 factors were identified as various food groups such as i) bakery items (13.7%), ii) snacks (4.2%), iii) bread, jam, sauce (3.6), iv) non-vegetarian food (3.5%), v) milk and milk products (3.4%), vi) rice based foods (3%), vii) Sweets (2.8%), viii) mixture & *samosa* (2.6%) ix) soft drinks (2.5%), x) *dahi-vada* (2.4%), xi) *parota and papad* (2.3%) xii) hot beverages (2.2%), xiii) *chapatti* (2.2%), xiv) non-vegetarian *curry* (2%), etc. that explained 58% of variation (**Table 23**).

7.9 Multiple Logistic Regression Analysis

To adjust for potentially confounding variables and to identify possible associated factors for overweight and obesity, a multivariate logistic regression analysis was carried out. In the model, although overweight and obesity was dependent variables, socioeconomic and demographic status of parents, physical activity such as participation in sports and games, household activities, aerobic exercises, likes and dislikes of junk foods and physical inactivity such as watching television, playing computer/video games and doing home work/tuitions at home formed as independent variables. This analysis revealed that the risk of overweight and obesity was 3 times higher among the adolescents, who were not participated in out door games and sports and 2 times, who participated <6h/week, 1.5 times, who belonged to high socioeconomic status, 2 times among adolescents, who were not participated and/or participated < 2h/day and 2 times, who were watching television ≥ 3 hrs/day (**Table 24**).

7.10 Institutional Profile

A significantly higher proportion of adolescents attending private educational institutions were taking part in outdoor games ($p < 0.05$) like lawn tennis and were practicing yoga and meditation ($p < 0.01$) compared to children / adolescents of government institutions.

The teacher to student ratio was observed to be significantly ($p < 0.01$) higher in government institutions compared to private institutions.

8. DISCUSSION

This is perhaps, the first comprehensive study covering statistically adequate sample in India attempting to document the prevalence of overweight and obesity and its determinant factors among urban adolescents of 12-17 year old at the State level. The study has been carried out in the three regions i.e. Telangana, Coastal Andhra and Rayalaseema of the State of Andhra Pradesh. The overall prevalence of overweight and obesity ($\geq 85^{\text{th}}$ percentiles of BMI) [35] among the urban adolescents was about 6%, which was about 6 folds higher than that of rural counterparts (1%) reported in the National Nutrition Monitoring Bureau (NNMB) surveys [40] in the same year. However, the prevalence observed in this study was lower compared with sporadic studies carried out in various cities [41] such as Ludhiana, Pune, Delhi and Chennai.

The reason for higher prevalence of overweight (26%) and obesity (7.4%) among the urban adolescent population studied in Delhi and Ludhiana could be due to confinement of study for cities and selection of the subjects from very affluent societies and few schools. In addition, the criteria used for definition of overweight and obesity was James et al BMI classification and not age / sex specific BMI centiles, the National Health and Nutrition Examination Surveys (NHANES) or IOTF/Tim Cole standards suitable for growing adolescents, which are commonly being used globally. In some of the studies, even though NHANES/IOTF/Tim Cole BMI age and sex specific centiles were used, the sample/subject selection was restricted only to high socioeconomic strata. In the present study, it has been observed that the prevalence of overweight and obesity was about 10% among the adolescents of high socioeconomic status, which is comparable that of the earlier study findings carried out among urban adolescents in Hyderabad, Andhra Pradesh [34]. The prevalence of overweight and obesity was significantly higher among girls in the present study, which is comparable with figures reported for other developing countries [41, 42].

A clear socioeconomic gradient in the prevalence of overweight and obesity was also observed in the present study, which is consistent with those earlier studies as well [41]. This reconfirms association of prevalence of over weight with high socioeconomic status. It has been reported that the rise in sedentary behaviours such as increased use of vehicular transport and decreased physical activity lead to increased prevalence of overweight and obesity [43]. The dietary habits of the children and adolescents with indulgence in high fatty foods intake and sedentary life styles in the higher socioeconomic group are well known causes for overweight and obesity. The prevalence of overweight and obesity was marginally higher in the age groups of 12, 13 and 17 years, which was not statistically different.

The results clearly indicate that regular physical activity was one of the important factors for lower prevalence of overweight and obesity. The prevalence was also significantly ($p < 0.05$) lower among the adolescents, who participated regularly in the household activities, played out door games and performed physical exercises. The average duration of participation of controls in out door sports and games (3.7hrs/week) was significantly higher ($p < 0.001$) as compared to cases (2.3hrs/week). In addition, the prevalence of overweight and obesity was higher among the adolescents who were involved in sedentary activities such as spending ≥ 3 hrs/day watching television, which is

consistent with earlier studies. Klesges et al, reported the effect of watching television on metabolic rate and prevalence of overweight and obesity among adolescents [43]. In urban areas, considering the safety of keeping children away from the heavy traffic congestion, parents feel more comfortable, if their children played indoor games or watched television, consequently hindering their children participation in out door games and sports. The diet survey carried out by 24-hour recall method also revealed that the intake of energy and protein among overweight and obese adolescents was significantly higher as compared to non-overweight and non-obese adolescents.

Freedman et al elucidated the adverse effects of overweight in the 17 year follow up study and reported that an average increase of 0.5kg/m² of BMI in children increases the risk for hypertension, dyslipidemia, and diabetes (type 2) a decade later [44]. The study also indicated that a higher proportion of overweight and obese adolescents (8%) were suffering from hypertension as compared to non-overweight and non-obese adolescents (4%). It was interesting to note from this study that about two third of overweight adolescents perceived that they were overweight and expressed willingness to take preventive measures. The proportion of adolescents with overweight and obesity was high in the Telangana region, most probably due to higher parental literacy status.

The multiple logistic regression analysis showed that the physical inactivity was one of the important correlates of overweight and obesity among adolescents, which is consistent with other studies [34].

Factor analysis was used to derive food patterns based on the information collected on 61 food items from 789 adolescents using semi-quantitative food frequency questionnaire (FFQ), which identified 18 food groups and explained about 58% of variation.

A significantly higher proportion of adolescents attending private educational institutions were taking part in outdoor games ($p < 0.05$) like lawn tennis and were practicing yoga and meditation ($p < 0.01$) compared to children / adolescents of government institutions.

9. CONCLUSIONS

The over all prevalence of overweight and obesity in the urban areas was about 6%, which was significantly higher among girls (7.1%) as compared to boys (4.4%) with significantly higher among high socio-economic groups (9.6%). The proportion of

overweight and obese adolescents was marginally higher in the Telangana region (6.8%) as compared to Rayalaseema (5.4%) and Coastal Andhra (4.8%).

The major correlates for the overweight and obesity among urban adolescents were physical inactivity such as duration of watching television, carrying out homework/ tuition/playing video or computer games, high socioeconomic status of parents, consumption of junk foods such as vegetable/non-vegetarian puffs, burgers, pizzas, cakes, pastries, high intake of energy and protein. The involvement in physical activity such as participation in outdoor games/sports, household activities and physical exercises were associated with low prevalence of overweight and obesity. High body fat percent in adolescents was also associated with high prevalence of overweight and obesity. The prevalence of hypertension was also significantly higher among overweight and obese adolescents as compared to control group.

10. RECOMMENDATIONS

The results provide several leads to encourage physical activities during adolescence and improve or modify the existing unhealthy food habits of adolescents to prevent overweight and obesity. The role of physical activity, games and sports are to be emphasized in the schools and colleges by teachers and management. Put suitable mechanisms in place to achieve the problem of escalating physical inactivity and sedentary life styles among urban adolescents. Promotion of healthy food and life style practices and regulated TV viewing could go a long way in preventing overweight and obesity among adolescents. Facilities at the schools and colleges should be made available to promote and regular monitoring weights of the school children, encourage aerobic physical exercises, participation in sports and games made mandatory in the school curriculum. Health and Nutrition education should be imparted regularly in all the schools and colleges.

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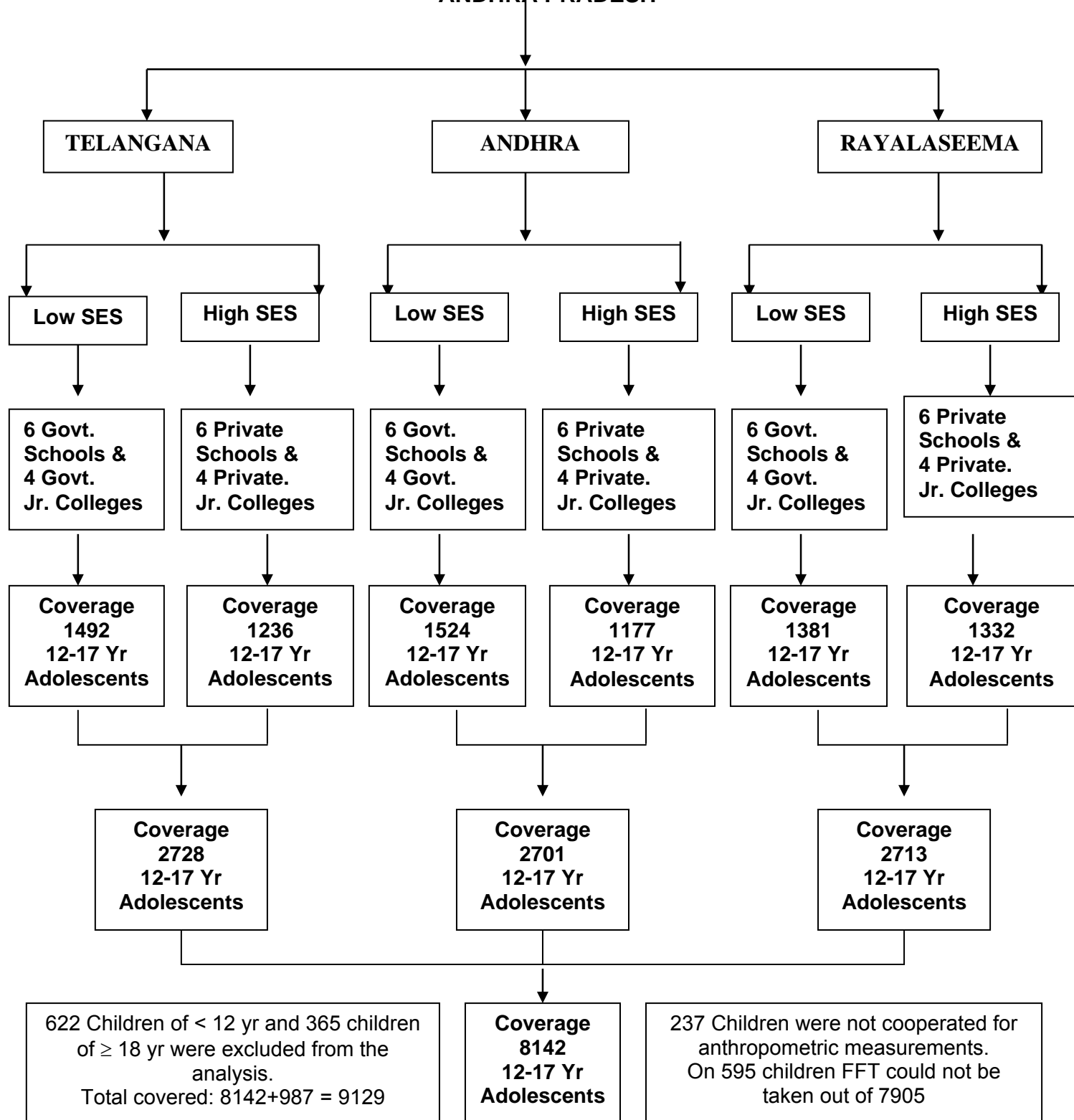
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Fig. 2

FLOW CHART FOR SAMPLE COVERED

ANDHRA PRADESH



Out of 448 overweighted adolescents detected, 314 were covered as cases.
 92 adolescents were absent on the subsequent days of survey.
 42 adolescents were non co-operative.